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Ministry of Education
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Hon. Bette Stephenson, M.D., Minister
Dr. H.K. Fisher, Deputy Minister

Curriculum Ideas for Teachers

1980

This support document to *The Formative Years*, one of a series dealing with the conservation of energy, provides information, student material, and suggestions to teachers for presenting this topic in the Primary Division.

We Really Care About Water and Air!

Energy

P1

Contents

Titles in this series are:

We Really Care About Water and Air! (P1)
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Energy One Hundred Years Ago (P7)
Where Does Energy Come From? (P8)

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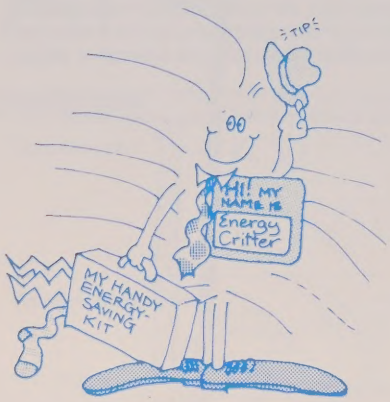
Introduction

Water and air are vital to human beings. Without them there would be no living plants or animals on earth. The purpose of this unit is to help children identify the importance of air and water to life on this planet, and to become aware of the characteristics of water and air and of their uses and misuses in our daily lives.

Through their work in this unit, the children will discover the source of our water supply and how water and air are used to produce energy. They will also develop an awareness of the energies involved in treating water to make it potable and in treating sewage that is to be returned to our lakes and streams. A simple experiment is included to show how water can work machinery, which in turn leads to the mention of water as a source of power, a topic that is further developed in the Junior Division.

Problems with water and air are not new; however, the extent of the problems that exist today has never been faced before. These activities will help you make the children aware of the importance of using our air and water wisely and of the role they can play in helping to remedy the problems.



Water and air have been presented as separate topics in the activity sheets. The sequence of activities moves from an emphasis on the importance of water and air to our existence, to how we use them, to an understanding of how we misuse these resources and of how we can help to conserve water and air for the future. Ideas involving electricity are found in activity sets 5, 8, and 10. Lifestyle activities are generally found under the heading "Follow-up Activities" in each activity set.

Most of the activities can be carried out in the classroom using materials that are readily available. Safety precautions will be necessary in some cases. The materials are designed to be used with all Primary grades. It is hoped that you will adapt the activities to meet the particular needs of your own students.

The theme "water and air" may be used over a four-week period, or it may be extended over a year, depending on how you choose to present it to your students.

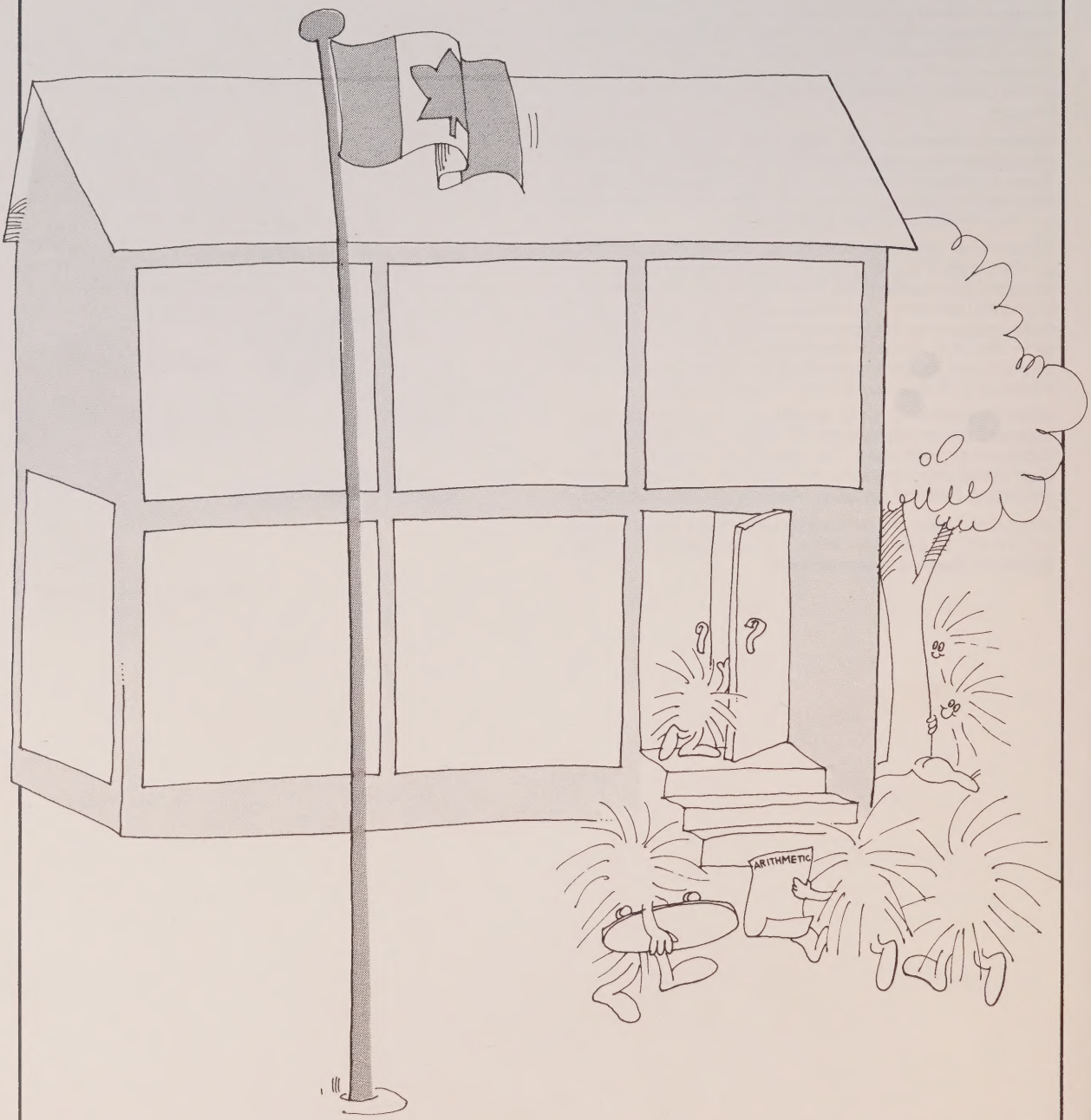
Name:

Uses of Water

How do we use water at school?

Take a walk around the school to look for the uses of water.

Make a picture in each window to show how water is used.



Use the back of the sheet to show how water is used at home.

Notes

There are many uses for water in our daily lives. This activity set is designed to help children become aware of the uses of water in the home, school, and community.

The estimated water consumption in the home per capita per day is 125 L to 187 L. The average consumption at school is 37.5 L. Energy is involved in purifying the water, operating and maintaining the system, collecting the sewage, and treating and discharging it.

To initiate this activity, you might have the children observe a classroom plant that needs water. They can discuss what they can do to make it healthier. Someone can be selected to go and get water for it. When the child returns, ask where he/she got the water. Elicit from the children the names of other places where they might find water (e.g., the school kitchen, fountains, the janitor's room) and a description of how we use the water from these places. Take a walk around the school to see if the children can add to their list of uses of water in the school. They should note its use in drinking, washing, cleaning, watering lawns, filling fish tanks, caring for animals, flushing toilets, mixing paints, and so on. Encourage discussion as they discover each use. Have them draw the pictures requested on the student activity sheet dealing with the use of water in the school.

Elicit from the children the ways they use water at home. Begin by having them tell how they used water before coming to school in the morning. Expand their ideas to other uses during the day such as for laundry, recreation, and cooking. The children may suggest different uses that they have for water during the weekend (e.g., washing the car, filling a pool). Have the children make six pictures to illustrate uses of water in their homes. The pictures could be made on the back of their activity sheets and could be entitled "Uses of Water".

Follow-up Activities

1. Have students discuss how water is used in their community. This activity may be initiated through:

– the use of magazine pictures or photographs;

– a discussion of the children's experiences;

– a visit to a park or downtown area; or

– a neighbourhood walk.

Their discussion should include the use of water for:

– lawns, gardens, fountains, fish, wildlife, pools, boating, and skating rinks in parks;

– cleaning, car washes, fountains, and street cleaning in the downtown area;

– lawns, gardens, bird baths, pools, rinks, fire hydrants, barbecues, cement mixing, and sewers in the home neighbourhood.

A co-operative chart like the following one could be developed:

We Use Water in Our Community

Neighbourhood	Downtown

Park

2. With the students make a class chart like the following one to compare hot- and cold-water uses. Discuss the idea of heating water and the hot-water tank so that the children will be aware of the energy involved. Ask students to compare each side of the chart and identify ways by which hot water could be saved (e.g., by using cold-water detergents). This could be an individual or large-group activity.

Hot-Water Uses	Cold-Water Uses

3. Visit a firehall with your students to find out how firefighters use water at the firehall and when putting out fires in the community.

Related Ideas

1. Make a co-operative chart like the following one. This could also take the form of a stencil, with the children cutting and pasting the sentences into a blank booklet and illustrating them.

We Use Water

We drink water.

We feed our pets water.

etc.

2. Have the children make a collage of magazine pictures showing uses of water, or have them paste these pictures on a chart and label each use.

3. Have the children take photographs showing uses of water at school, at home, or in the community. They could carry out this activity at home with their own cameras or in a small group at school using the school's equipment. The children should:

– explain why they took the pictures they did;

– classify the pictures under uses in the home, school, or community;

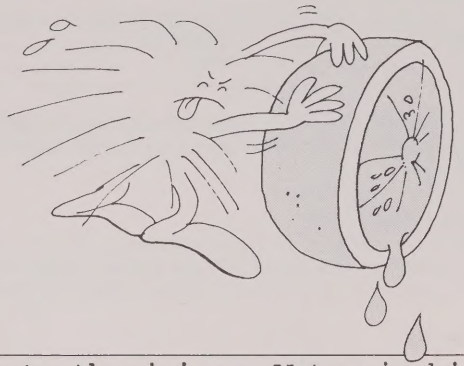
– classify uses under the headings "necessary uses" and "waste".

Name:

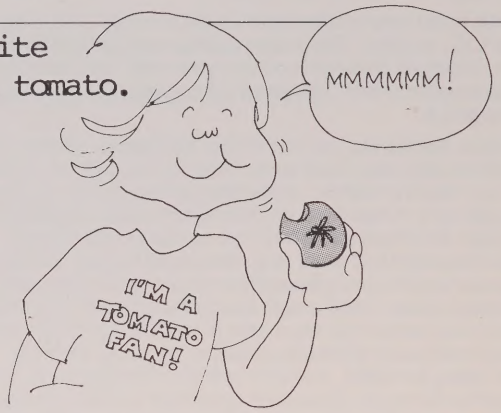
Water Hides in Many Places

Can you find water? Try these activities.

1. Squeeze an orange.

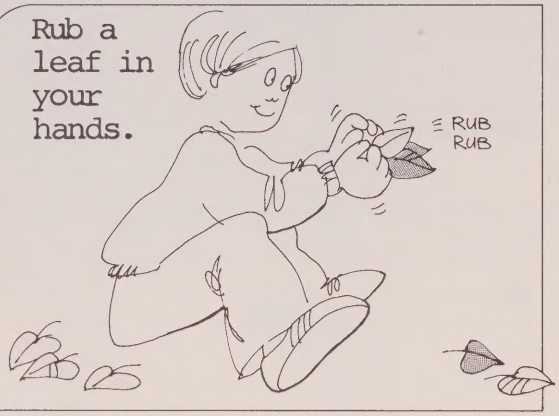


Bite a tomato.

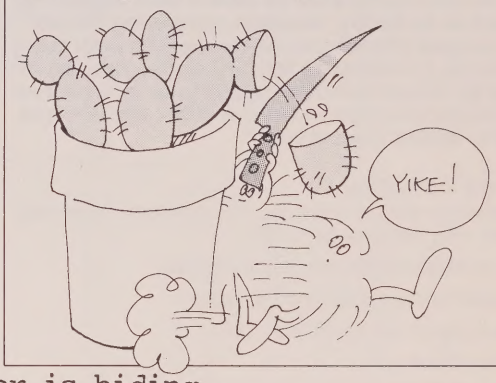


Taste the juices. Water is hiding _____.

2. Rub a leaf in your hands.

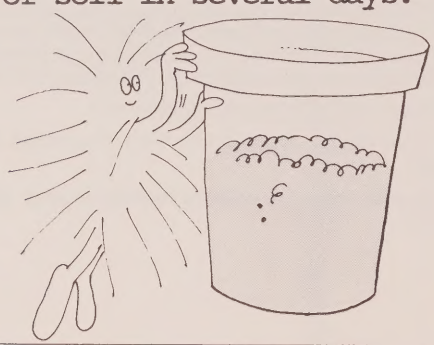


Cut a pad. Touch it.



My hand is _____. Water is hiding _____.

3. Check the covered dish of soil in several days.



What did you notice?

On my dish I saw _____. Water is hiding _____.

On the back of this sheet, show other places where water is hiding.

Notes

Opportunities can be provided to help children discover that water can be found in many hiding places if they look for it. Have the children observe a filled hot-water bottle. Ask them what is in it. Can they see the water? Develop the idea that we cannot always see water unless we look for it. Have them suggest other places where they can release concealed water by taking some action. A trip to a water fountain might prompt them to suggest such things as hydrants, taps, hoses, showers, and water pumps.

Set up the experiments outlined on the student activity sheet to help them discover other places.

Follow-up Activities

1. Provide the children with a glass of very cold water. Have them leave it for a few minutes in a warm place and observe the condensation that takes place. Ask the children where the water on the outside of the glass came from. Help them develop the concept that there is water in the air.

2. Show the children picture flashcards of such things as a fire hydrant, tap, shower, fountain, hose, and water pump. Discuss with them what each picture is, what they would do to make water come out, and when they would use it. Have a firefighter explain how he/she uses the fire hydrant. This activity could be introduced by the poem "Drinking Fountain".

Drinking Fountain

When I climb up
To get a drink,
It doesn't work
The way I think.

I turn it up,
The water goes
And hits me right
Upon the nose.

I turn it down
To make it small
And don't get any
Drink at all.

Marchette Chute

From Catherine Shaefer McEwen (ed.), *Away We Go* (New York: Thomas Y. Crowell Co., 1956), p. 23. Reprinted by permission.

3. Show the children some dried fruit such as raisins, prunes, or dried apples. Soak the fruit in water and have the children note the changes. Have them make a list of the uses to which we put food that has had the water content removed (e.g., in a survival kit for camping, as food for astronauts).

Related Ideas

Students might complete any or all of the following activities:

1. Record the weight of a raw potato. Let it dry for several days. Weigh the potato to determine changes in weight. Discuss other ways to dry out a potato and the energy required to do so in each case. Note that energy is also required to cook the potato.

2. Set up a cooking centre. Make applesauce. Note the water content in the apples used. Discuss the energy used in growing, packaging, delivering, and cooking them.

3. Use the following method to make apple-head dolls: Peel an apple and carve a face in it. (Use a plastic, serrated knife.) Insert a stick in the apple, dip the apple in lemon juice, and leave it to dry. Make clothes from paper or material.

4. Cut a stalk of celery and put it in a glass of coloured water so that the transportation system of water through plants can be observed.

5. Make a display of dried foods and label them. Discuss reasons for using dried foods. Have a tasting party.

Name:

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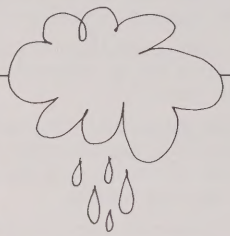
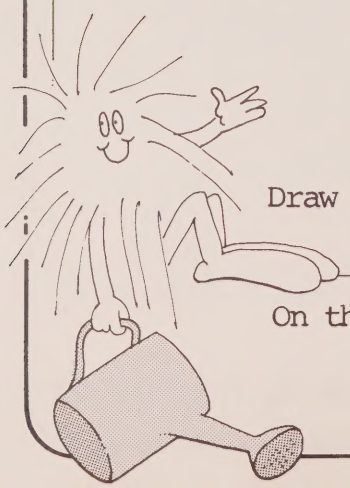
Do All Living Things Need Water?

Do plants need water?



Draw the plant that was watered.

Draw the plant that was not watered.



On the back, show other living things that need water.

Notes

Children may be led to the realization that all living things need water through observations and experimentation with living things. Next to the air we breathe, water is the most important thing in our lives. Without it, everything would die. The bodies of living things contain more water than any other substance: two-thirds of the human body is water. Water carries food through our bodies and removes our wastes. Plants cannot receive minerals from the soil unless the minerals are dissolved in water. Water is our vital need.

Have the children observe two plants. Discuss the conditions a plant must have in order to remain healthy (i.e., good soil, air, water, light, etc.). Ask the children if they can suggest a way to show that plants must have water to stay healthy. Perhaps they will suggest watering one plant and not the other. Have them carry out this experiment. In a few days, they can discuss the changes that took place and complete the student activity sheet. Have them use the back of the activity sheet to print descriptive words about the plant (e.g., wrinkled, dry).

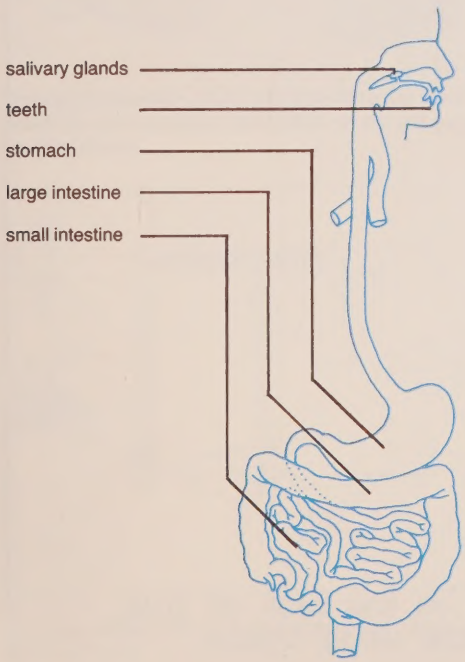
Follow-up Activities

1. Show the children how much of their bodies is water. Weigh a child. Determine two-thirds of his/her weight and fill a large bucket or tub of water to this measurement. The children can then compare their water weight to the remainder of their body weight.

Have the children suggest useful ways to use the water in the tub on completion of this activity. Discuss the idea that people and energy were needed to bring this water to us.

2. Why do we need water? Have the children put cookies or some food in a jar and shake the jar well. This same activity should then be repeated with another jar, but this time water should be added to the jar before it is shaken. Students should consider these questions: What changes occur in the food? Why is this process important to our bodies? A discussion of the digestive system should be developed from this experiment.

Digestive System



3. Invite a veterinarian to visit the class to discuss the needs and care of animals. Have him/her include information on the gerbil and camel, noting their special characteristics and adaptations to warm, dry climates.

Related Ideas

1. Make a display of food labels. Circle the water content printed on each. The labels could be ordered according to the amount of water in the contents.

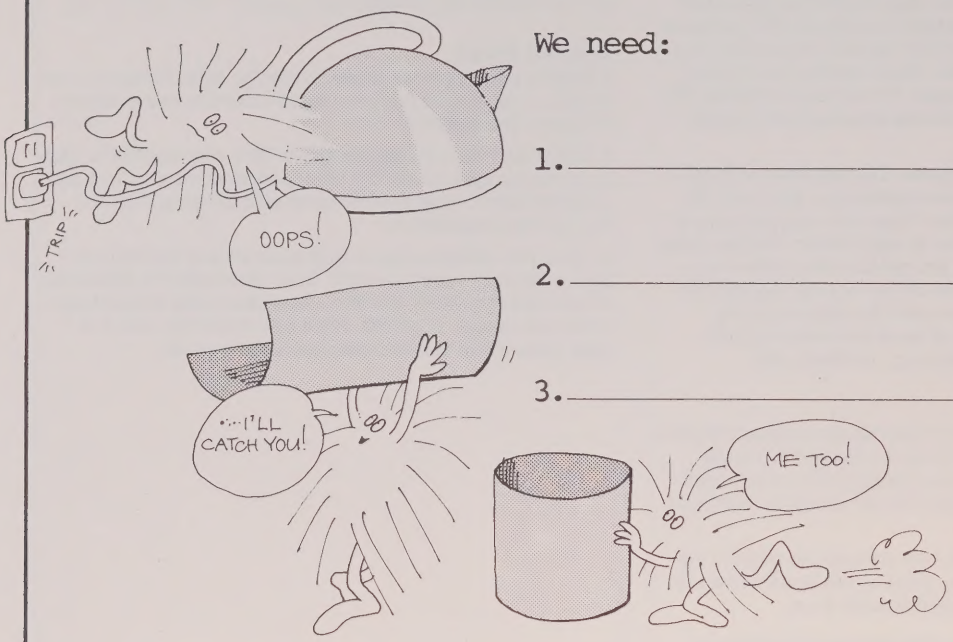
2. Divide the class into groups of two. Give one member of each group some crackers and the other partner some crackers *and* a drink of water. Have them observe each other as they eat. Discuss their experience.

3. Show the children a dry red kidney bean and one that has been soaked in water overnight. Have them note the difference in size. Plant the moist one in a *clear* glass so the children can observe its stages of growth. Plant a dry one in dry soil in a clear glass. Have the students observe the results.

Name:

10

The Magic Water Circle



We need:

1. _____

2. _____

3. _____

Show what happened.

Draw a picture on the back of this sheet to show the water cycle.

Notes

Have the children note the areas of land and water on a globe. Discuss where water is found (e.g., rivers, streams, oceans). Have the children decide, through their observations, whether there is more land or water.

Three-quarters of the earth's total area is water, and the water cycle explains where this water comes from. As the sun shines down and heats water, its molecules become very active. They are bumped into the air as warm water vapour. This process is known as "evaporation". As warm air rises, so does the vapour. It cools as it rises and changes into tiny water droplets. These droplets form a cloud. As the cloud is carried into colder areas by wind and air currents, the tiny droplets group together to form raindrops, snow, hail, and so on. The rain falls, replenishing the earth with water and completing the cycle. However, although water is a renewable resource, it *must* be conserved because it does not always return when or where it is needed.

Set up an experiment to demonstrate the idea of the water cycle. (Safety precautions are most important during this experiment.) You need a kettle, a piece of metal or a metal pan, and a container. Heat the water in the kettle to boiling and have the children observe the change of water to steam.

Relate this to the work of the sun on a body of water. Have the children observe the condensation of the steam on the pan (held above the steam), and relate this to vapour meeting cold air in the sky. Have the children note the droplets falling into the container just as rain falls from the clouds. Ask the children what causes rain to fall as snow. Have the children illustrate this experiment on the student activity sheet as in the accompanying illustration.

Through discussion, relate this experiment to the water cycle, using the accompanying illustration, which can be reproduced on chart paper.

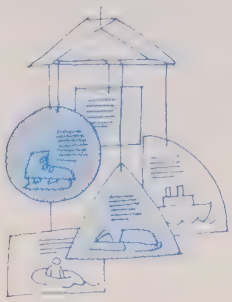
Have the children illustrate the water cycle on the back of their activity sheets.

Follow-up Activities

1. Repeat the experiment on the student activity sheet using salt water. Have the children taste the water collected in the bottom of the container. What did they notice?

2. Leave salt water in a dish for several days. After the water has evaporated, have the children note what remains in the dish. Relate this to the salt water in the oceans.

3. How do we use our sources of water (lakes, streams, etc.) for transportation and recreation? Pictures could be used to initiate a discussion. The children can make mobiles using shapes cut from blue paper. They can then cut and paste or draw pictures to show how we use water for transportation (e.g., on the ocean, in the logging industry, on snow) on one side of these shapes and to show how we use water for recreation (e.g., skating, fishing) on the other side.



Related Ideas

1. Have students find out where the source of water is for homes in their community (e.g., reservoirs, water towers, lakes). Discuss with them other sources of water such as streams and wells, as well as the use of pumps.

2. Have the children mime the story of a drop of water, from its beginning in a lake through each phase of the water cycle.

3. Have students paint a picture to show how water can be harmful (e.g., through floods, storms, fog, ice).

4. Do a quantitative study using a container of snow and a similar container of water. Have the children note the difference in quantity between the two after the snow has melted.

5. Have the children listen to the poem "Cloud Animals", which is reproduced here. Discuss where the clouds came from and what will happen to them. Go outside with the children to observe shapes in the clouds. Have them write a co-operative or individual story about clouds. Ask them to paint a picture to show what they saw in the clouds.

Cloud Animals

The clouds in the sky
Have the funniest shapes –
  Of lions
  And tigers
  And zebras
  And apes.

They twist and they turn
And they split into two.
I'm sure that in heaven
There must be a zoo.

From Ilo Orleans, *Gingerbread Children*
(Chicago: Follett Publishing, 1973). Reprinted by permission.

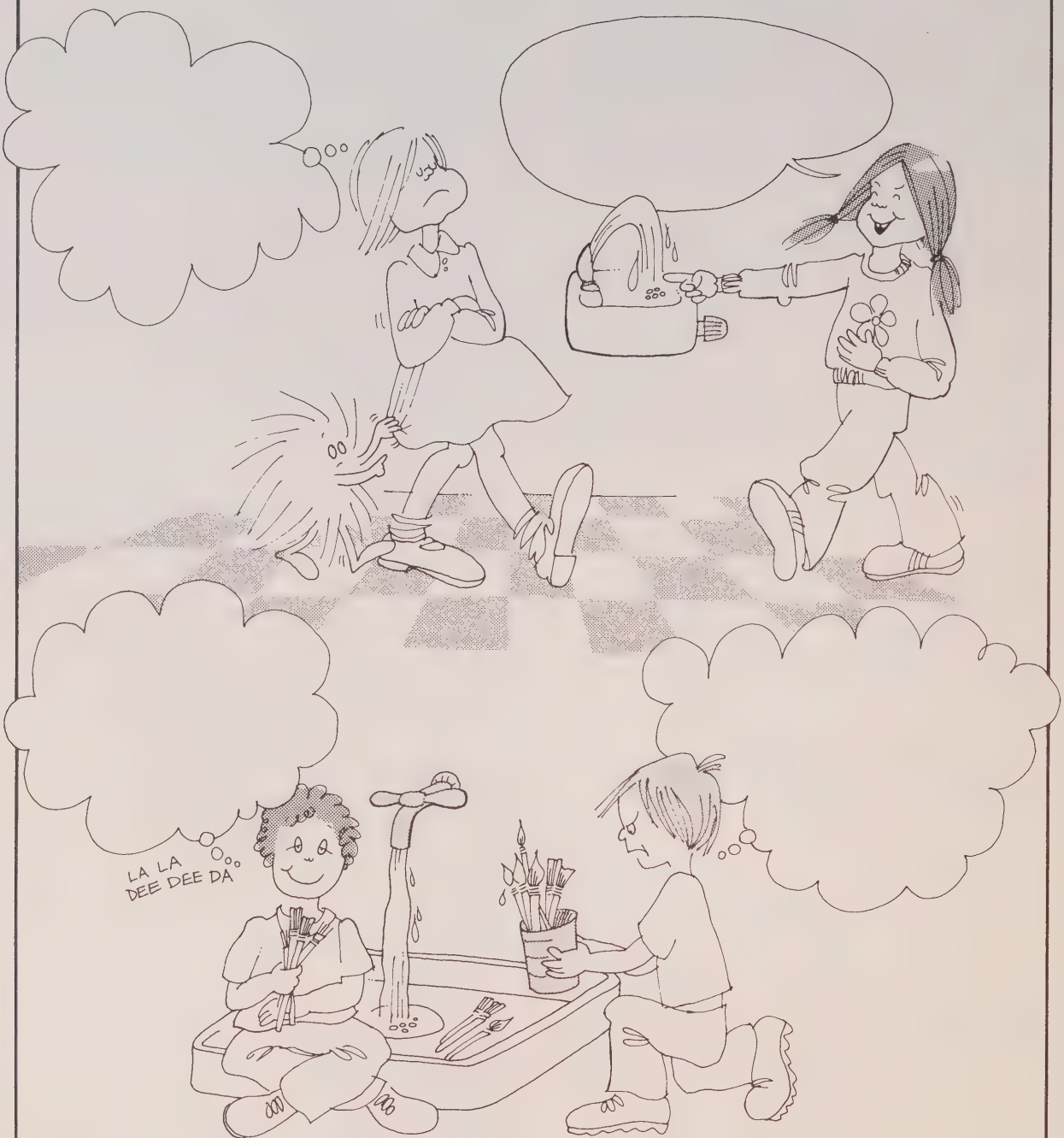
6. To illustrate to the children the relationship of land and water in the world, place a transparent grid over a map of the world or around a globe. Have the children count the squares of land and water areas, and compare them.

Name:

12

Water Waste

In the empty balloon in each picture, fill in what you think the children are thinking.



On the back, show ways we waste water at home.

Notes

A great deal of our water supply is wasted in our daily routines at school, at home, and in the community. This activity set encourages children to identify situations in which water is being wasted, to become aware of the energy involved in heating water, and to suggest ways by which they can help conserve our water supply and save energy.

Booklets and advertisements are available that suggest ways we can save water and energy in the home. The amount of water used in a day can be reduced by checking for dripping taps, taking a shower instead of a bath, using a suds-saver attachment on the washing machine, and cooking vegetables in a small amount of water.

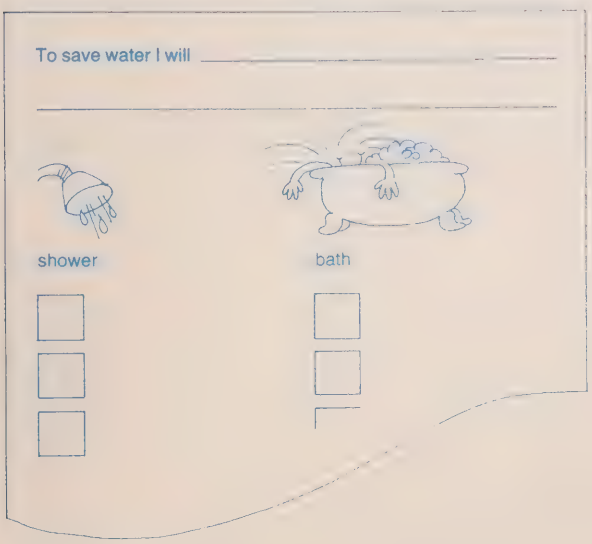
Hot-water waste can be decreased by using cooler water settings on an automatic washer, by using cold-water detergents, and by using a dishwasher only when it is full and then letting the dishes dry in the air. Pipe runs and hot-water tanks can be insulated to avoid heat loss.

Have the children observe the pictures on the student activity sheet. Discuss where the children are and what they are doing in each picture. Students might be asked the following questions: What is wrong in the picture? What would you do if you were this child? Why is it important not to waste our water? (Reasons might include the cost of heating it, the cost of purification, the fact that the amount of rainfall is unpredictable, etc.) Have the children suggest other times when we waste water, both at school and at home. These might be recorded on chart paper as the children mention them.

Follow-up Activities

1. Leave a tap dripping at the rate of about one drip per second. Place a container underneath to catch the water. Measure how much water is wasted in a given time. Discuss with the children what could be done to remedy this problem (e.g., taps could be carefully checked after use to insure they've been turned off, faulty washers can be replaced). Have the children suggest ways they could use the water collected in this activity.

2. The students can ask their parents to help them with this activity. Have the children take a bath one night and mark the level of water in the tub. Another night, have them take a shower with the plug in, and mark the level. Ask them whether it took more water for a bath or for a shower. Make a block graph to show the results to the class. Record each student's finding in a separate block.



3. a) Discuss with your students how they would prepare a vegetable for cooking. List or draw the steps on a chart. Ask them if they can suggest any way that water can be saved in cooking activities. Cut the chart into strips and have the students order the sentences.

b) Prepare vegetables as suggested on the chart above. Set up two pots containing the same amount of vegetables. To find out how much water we really need for cooking, put 115 mL of water in one pot and a large amount of water in the other. The burners should be set at the same intensity. Have students record the length of time it took to cook the vegetables in each pot. Ask them the following questions: Which pot took longest? Why? Was all that water needed? Why not?

4. Repeat the previous activity using 115 mL of water in each pot. Cover one pot but not the other. Have students determine in which pot the vegetables cooked faster and note the electrical energy saved by cooking in a covered pot.

Note: These activities could be carried out in the classroom, using a two-burner element. Safety precautions must be taken, however. These activities could also be done in small groups in the school kitchen with the supervision of a parent-volunteer.

Related Ideas

1. Have students make a poster or picture to show one way to save water and print a sentence or slogan to tell about it.

2. Have the students make a list of hot-water uses in the home and discuss which ones can be reduced to conserve energy.

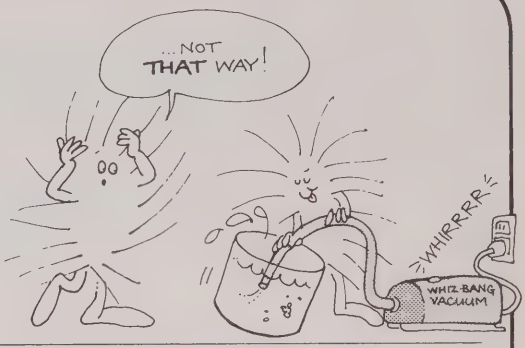
3. The children could act as detectives and record incidents at home or at school in which they found water being wasted. This might take place over a two-week period. The detectives could report their findings to the class and suggest measures that could be taken to prevent this waste.

4. Have the children put the plug in the sink when they begin to brush their teeth, and measure how much water they waste as they carry out this activity. Have them share their discoveries.

Name:

Is Water Clean?

This is _____ water.
(lake, river, pond, etc.)



Is it clean?

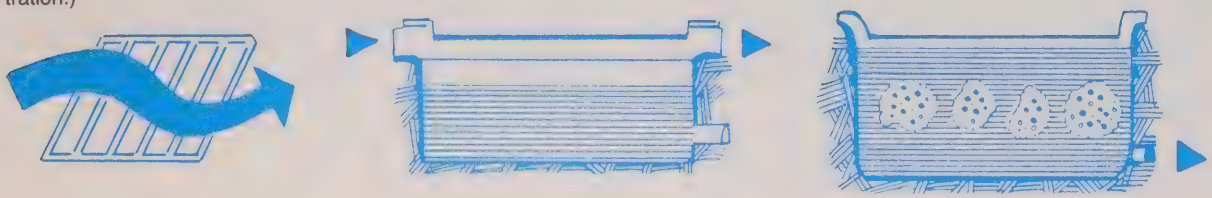
Can we make it clean?

We used ...	We did this ...	Was it clean?

On the back, show other ways we can use to make water clean.

Notes

We require potable water for use in our daily life. Not all water is potable, and steps must be taken to make non-potable water suitable for our use. To do this, the water that is drawn from a lake, a river, or a deep well is first filtered through metal bars to stop pieces of wood, tree branches, or other large objects from entering the purification plant. It then flows into a tank where chemicals are added to make any small particles contained in the water cling together and sink to the bottom. This sludge (mud) is removed. The water then goes slowly through a filter of sand and gravel so that minute particles in the water can be trapped. This clean water is then piped to a storage tank, where chlorine is added to kill bacteria. (See the accompanying illustration.)



Source: Ontario, Ministry of Education, *Energy in Society: A Resource Guide for Teachers* (Toronto: Ministry of Education, Ontario, 1978), part 4, p. 39.

Bring in a sample container of muddy lake or river water and discuss the following questions with the children:

– Where do you think the water came from? Why?

– Would you drink it? Why or why not?

– What do you think might be in it?

– How does this water compare with tap water?

– How can we make our sample clean?

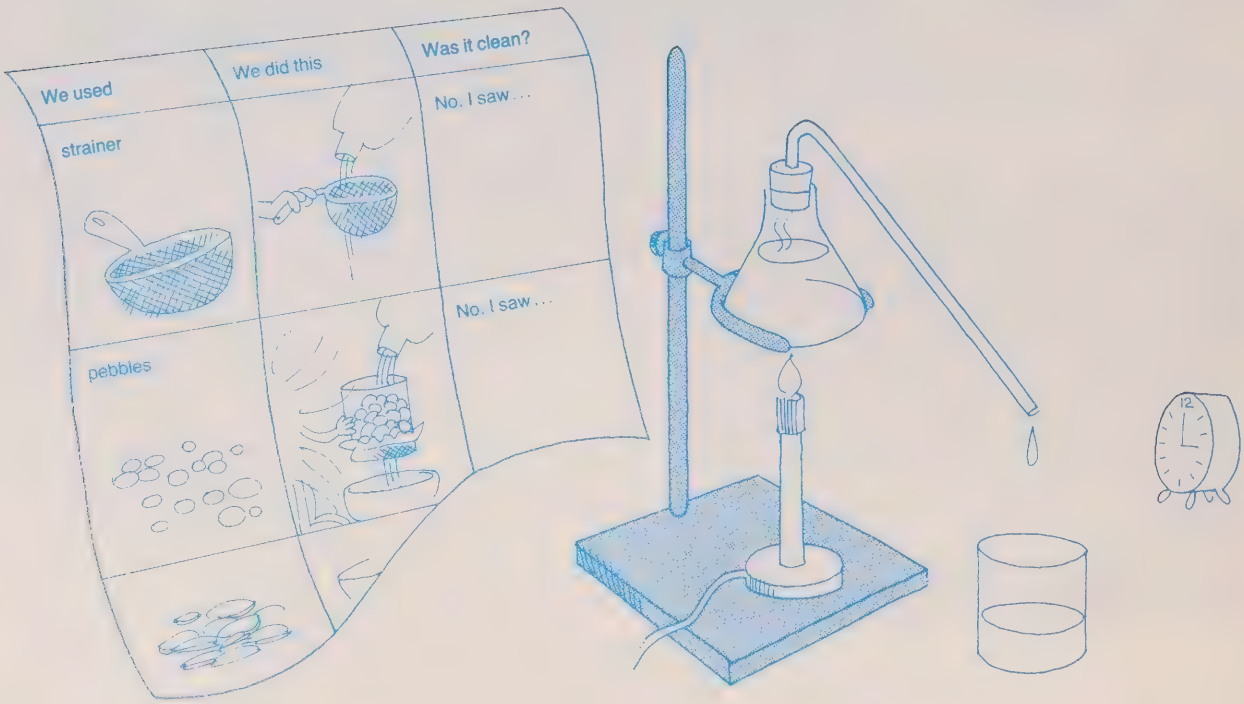
Develop with the students the idea of using a strainer to remove large particles from the water first, and then of using clean aquarium pebbles, sand, cheesecloth, filter paper, and coffee grounds to remove other impurities. Have the children work through these experiments, observing the water after each process.

The students should record the process and results using pictures and/or sentences on the student activity sheet as shown below.

After working through the experiments, discuss the purity of the water with the children. Is it pure enough to drink? Is this a suitable method of purifying water for their community? Why or why not? You might introduce the purification plant through the use of a picture, and provide the children with information relating it to the experiments they did. Point out the energy required in pumping the water, and the resources needed to get it to our homes. Discuss how nature purifies water for wells and springs.

Follow-up Activities

1. Heat lake or stream water in a jar that has a rubber stopper and a glass tube connected to it (teacher demonstration). Have students observe this sample of water and compare it to a sample filtered through pebbles, sand, etc. They should compare the amount of water treated, the number of impurities removed, and the length of time each process takes. Safety precautions must be taken during this activity to prevent any injury due to flame or hot water.



2. Visit a purification plant with your class to discover how water is treated for use in our homes and what kinds of energy are involved.

3. Make a co-operative chart of pictures or a printed list of uses of water with the children. Circle the uses for which we need pure water and discuss the reasons why with them.

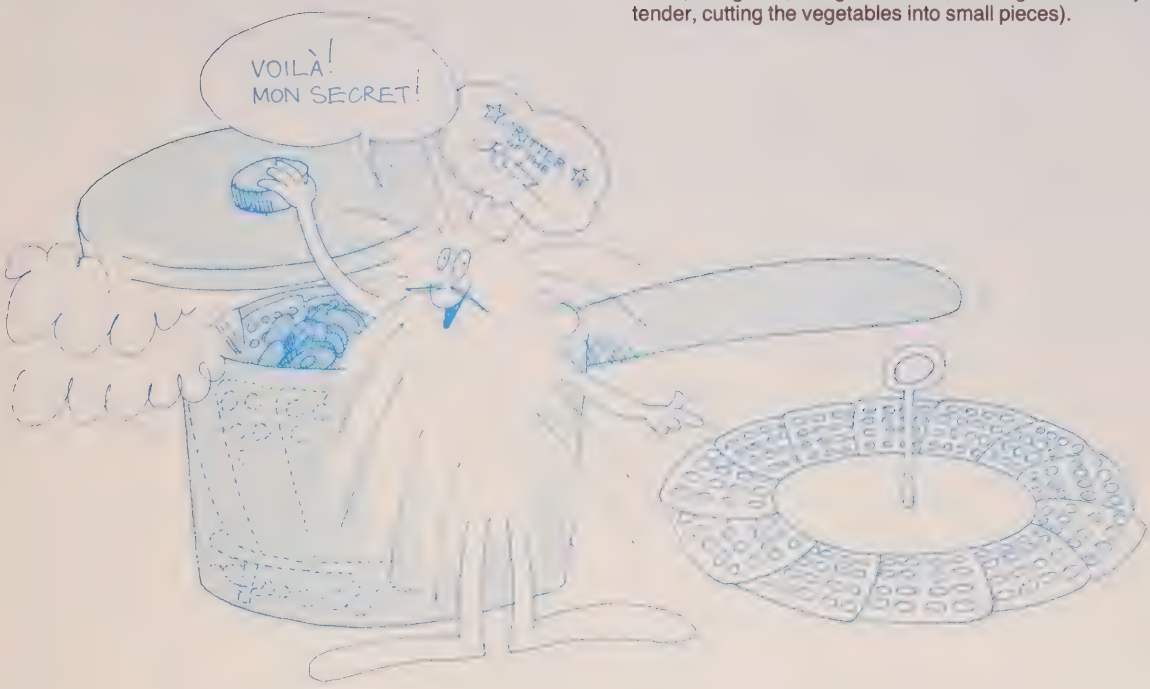
Related Ideas

1. To give the children some idea of the energy involved in lifting and pumping water to its location of use, have them carry a bucket of water up a flight of stairs. This could be done at home or at school. Discuss how they felt.

2. Is snow clean? Have students filter melted snow through filter paper to see if it is clean. Discuss what the particles in the water might be and where they might have come from.

3. Make a chart story with the children to show the steps taken to make water potable. Cut it into strips for use as a sequence activity.

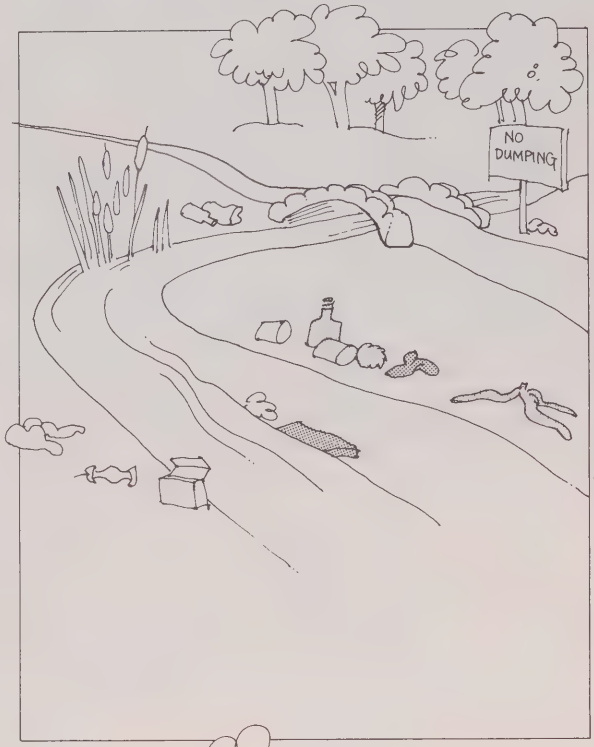
4. Discover with the children that they do not need clean water for cooking. Use a metal steamer, a pot, lake water, and carrots. Put a small amount of water in the pot. Place the steamer on top of the pot and cover with a lid as shown in the accompanying illustration. Bring the water to a boil and steam the carrots until they are cooked. Discuss: (a) if clean water was necessary; and (b) in what ways they saved energy (e.g., by not using too much water, using a lid, using lake water, cooking the carrots just until tender, cutting the vegetables into small pieces).

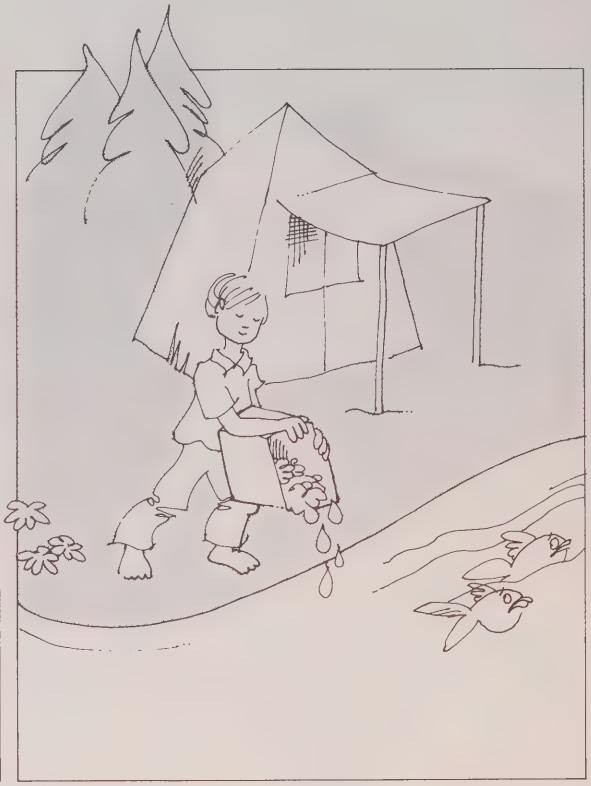


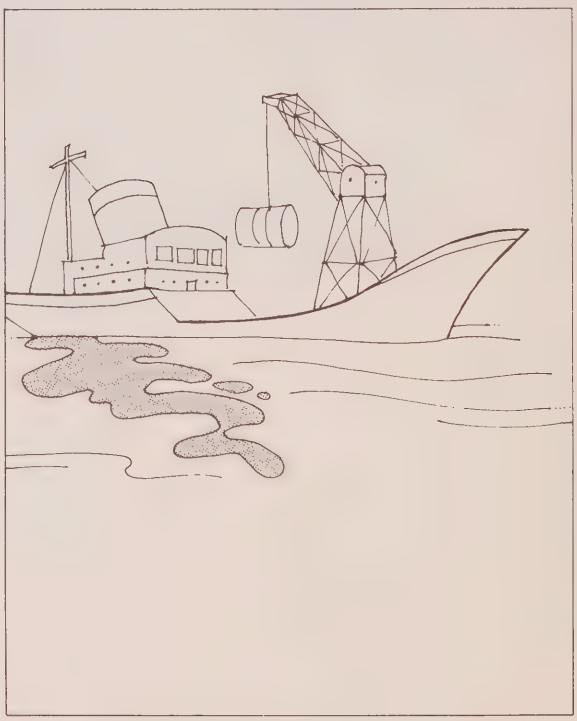
Name:

18

What Is the Problem?







On the back, show other ways in which our water is being polluted.

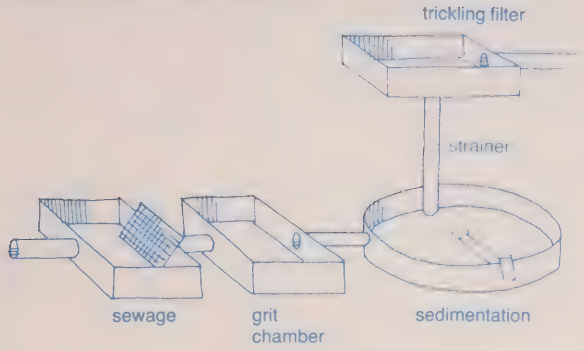
Notes

Pollution is a problem in our society. The purpose of this activity set is to identify ways in which our water is being polluted, how it affects our community, and what can be done to help remedy the water-pollution problem.

Pollution can be defined as "the destruction of the purity of water by impairing its quality to the point that it becomes unfit for the many uses for which we require it". Some causes of water pollution are oil spills; wastes from factories, mills, and industries; sewage from our homes; and soil erosion. Because sewage carries disease germs, it must always be treated before it is discharged into a lake.

In general, four steps are taken to treat sewage. In the first step, large solids are captured by metal screens. The sewage next proceeds to the grit chamber, where heavier solids such as soil and sand particles settle on the bottom. Following this, the water passes very slowly through a sedimentation tank, allowing suspended particles to sink. The water is then pumped off, to trickle over a specially treated rock filter. What remains is relatively clear water. As an added precaution, chlorine is added to the water before it is discharged into the lake or river. This process is shown in the accompanying illustration.

Where Does Waste Water Go?



In rural areas, sewage is kept in septic tanks. This system is based on the principle that in all surface soil there are certain bacteria that make waste matter harmless. A septic tank must be cleaned every three to five years.

The toilet uses 40 per cent of all water used in the home. Be sure the children understand the difference between sewage treatment and water purification. The purification plant prepares water so that it is potable. The sewage plant cleans used water only enough so that it can be sent back into the lake or river system.

Provide the children with a sample jar of lake water. Ask them what might make this water dirty. Discuss with them the meaning of pollution and the pictures on the student activity sheet, noting what is polluting the water, how it got there, and what might be done to help prevent this pollution. Have the children print a sentence under each picture (e.g., "Oil pollutes our water."). Find other pictures that show oil spills, sewage, factories, mills, mines, and animals as water pollutants.

Follow-up Activities

1. Have the children find out if their water waste at home goes to the sewage-treatment plant or if they have a septic tank. Have them find out the location of whichever of the systems they use.

2. Before visiting a sewage-treatment plant, discuss with the children what sewage is and where it goes. Why is it necessary to have a sewage-treatment plant?

3. Discuss with the children how polluted water affects plant and animal life. Have the children make a picture of a water scene in which the water is not polluted and one in which it is polluted. Discuss the differences in their illustrations.

4. Show the film *The Rise and Fall of the Great Lakes.* Ask the children to look for causes of pollution in the film and discuss what could be done to help remedy it.

Related Ideas

1. Have students write a co-operative class letter to an industrial company to ask for information on what kind of wastes it is sending out in the water and what steps it is taking to help end water pollution.

2. Have the children paint a picture to show three ways that water is being polluted.

3. Have the children build a large sand pile and then pour water down it to see how the soil is carried by the water. Demonstrate for them how farmers can plough their fields across a slope to keep water from running off and to keep valuable top soil.

4. Have the children observe muddy water under a microscope and draw a picture of what they see.

5. Have the children draw a simple diagram to show the steps in sewage treatment that must be carried out to clean water before it is returned to a lake.

Reference

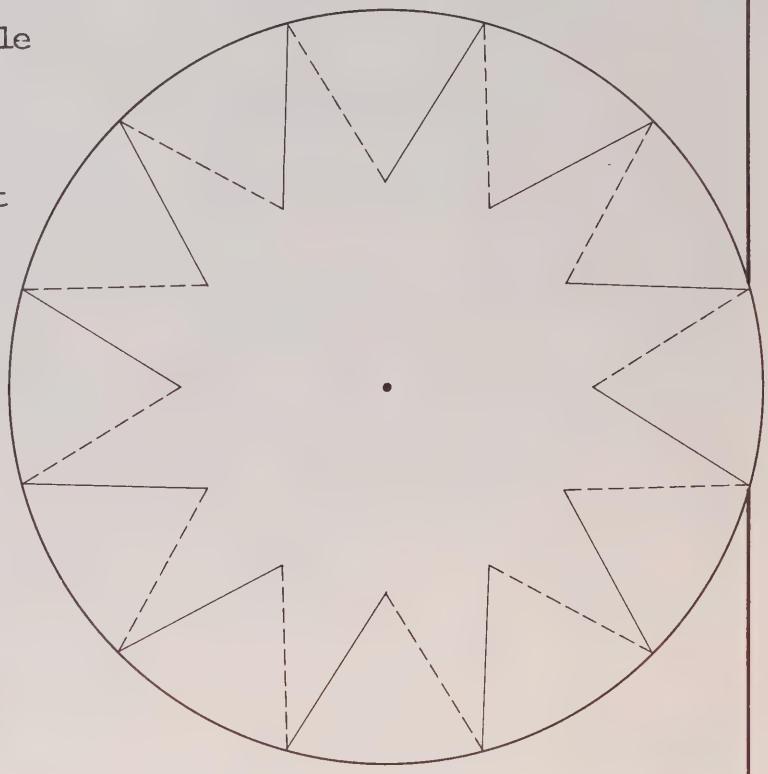
The Rise and Fall of the Great Lakes. National Film Board, 1968. 16 mm, colour, 17 min.

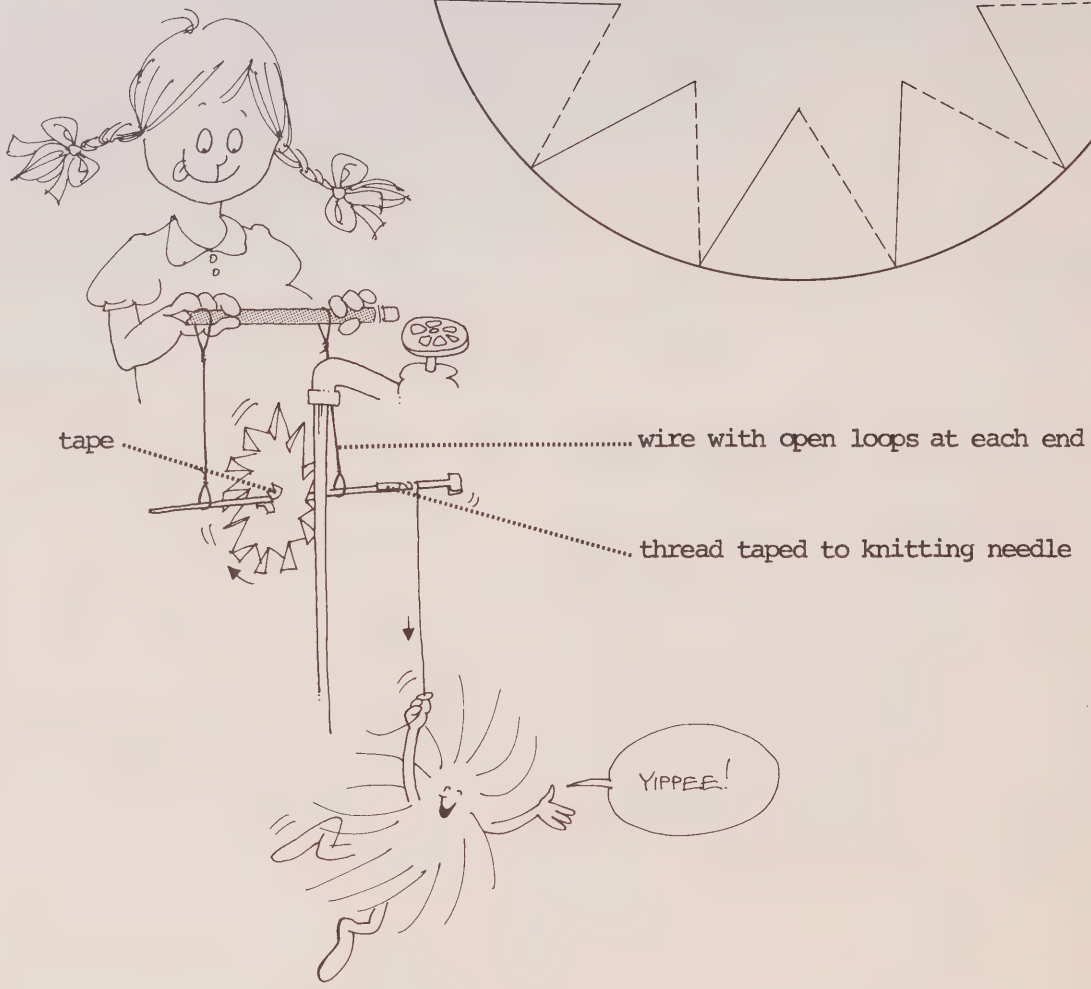
Name:

Make a Water Wheel

You need: a knitting needle
Bristol board
scissors
a pencil

Trace the pattern at right on Bristol board. Cut out the circle. Cut along the solid lines and fold on the dashed lines. Put the knitting needle through the centre of the wheel.





A water wheel can do work. Your teacher will help you.

Make a Water Wheel

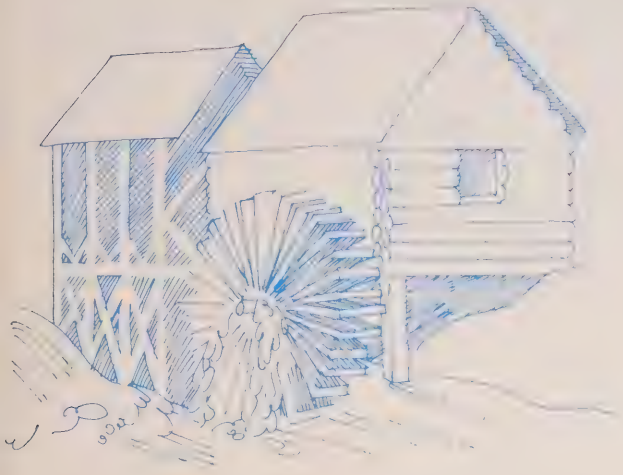
Notes

Water is a valuable source of energy, because it is safe, dependable, and controllable. This activity set shows how water can be used to make machinery run. Water wheels, for example, were a major source of power until the invention of the steam engine in the 1700s.

A water wheel changes the energy of falling water into mechanical energy, which can be used for running machinery (e.g., for grinding grain or sharpening tools). A water wheel is mounted on an axle, which is connected by belts to the machinery it is to operate. The wheel has many curved blades. Water from waterfalls and rapids in rivers is directed into the wheel. When the water strikes the blades with force, it causes the wheel to turn, which in turn rotates the shaft of the machinery.

Water became a source of electric power with the development of the water turbine, which runs generators, which in turn produce electricity. To make this happen, a dam is constructed in order to create an artificial waterfall that provides the moving water which is the energy source. Electricity is produced inside a large building located beside the dam.

Show the children the accompanying picture of a mill with a water wheel. Ask them what makes the wheel turn. Explain how the farmers brought their corn and grain to the miller to grind them in his mill. Discuss why a mill was situated near a river.



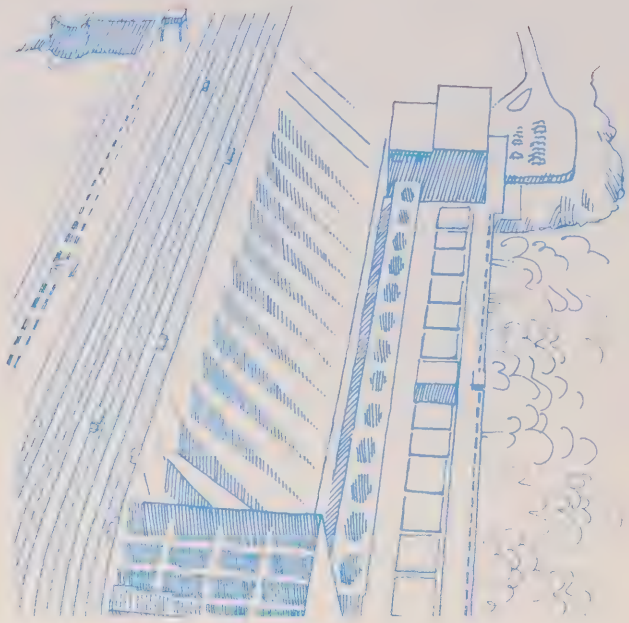
Have each student make a water wheel using the diagram on the student activity sheet as a pattern. The pattern is laid over a piece of Bristol board. The student cuts along the solid lines and folds on the dashed lines. A knitting needle is then placed through the middle. Holding the needle, the student pours water from a jug over the wheel to make it turn. The plug is placed in the sink drain and the water saved for other students to use. The first follow-up activity can be used to demonstrate how a water wheel can be used to do work.

Follow-up Activities

1. To show your class how a water wheel can do work, use the lid of a tin can and follow the pattern on the activity sheet. Attach a thread to the needle or axle and a light object at the other end of the thread. As the wheel turns, the axle turns, drawing the article upward. Tape the axle to the wheel so the thread will wind around the axle. When working with the tin, be careful of the sharp edges.

2. Take your class to visit a flour mill at a pioneer village to see how the pioneers used the water wheel to do work.

3. Show the class a picture of a hydro-electric power plant and dam. Discuss what is moving in the picture and where the water is going. Ask who has seen a waterfall and ask those children to describe how it looked, the noise it made, and so on. Explain that people build dams to create waterfalls and that they are built to use water as a source of energy. Electricity is produced when the moving water turns turbines, which in turn run generators that produce electricity.



Related Ideas

1. Have your students grind unprocessed bran, wheat, etc., between rocks to show how grain would be ground in a mill.

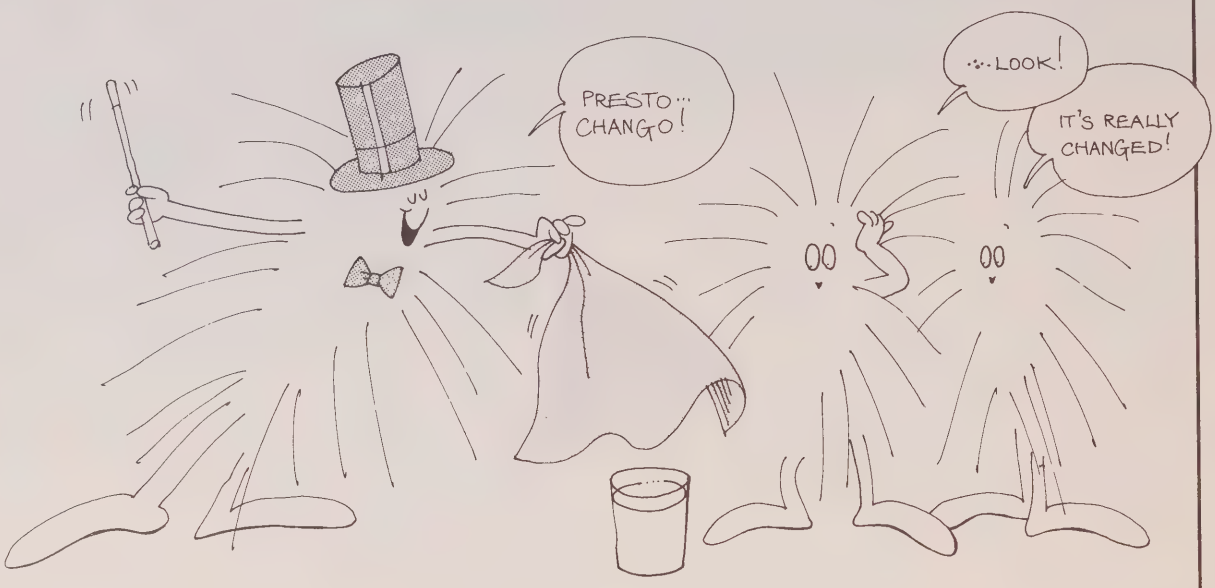
2. Take your class to visit a hydro-electric power plant.

3. With the students make a class chart of articles found in the home that require electricity. Discuss why it is important to turn things off when you are finished with them.

4. Work with your students to make a list of words that can be made from the letters in "water wheel".

Name:

Tricks With Water



Notes

Water is called a universal solvent. It can dissolve many substances, but we cannot see these impurities in the water. As it trickles through the ground or over a surface, it dissolves some of the substances there. It carries these substances to the oceans or lakes. When the sun evaporates the water, the dissolved materials are left behind.

Water can change its state from solid to liquid, liquid to solid, and liquid to vapour. It forms ice at a temperature of 0°C. When water freezes, it increases its volume, which explains why frozen pipes split and why freezing water damages a car radiator. Ice also adds to our health and comfort. It is packed into refrigerator cars to keep fruits, vegetables, and meat fresh when being shipped, and to reduce bacterial action. It chills beverages, cools coolers, and is used for skating and to reduce the swelling caused by injuries.

Vapour is a gaseous state into which liquids and solids pass when they are heated. The process by which a liquid or solid is converted to a vapour is called "vaporization".

Discuss the picture in the student activity. Ask the students who the man in the picture is and what he does. Tell them that they are going to do some magic using the items placed on a display table. Number baby food jars containing baking powder, salt, sugar, baking soda, fruit drink powder, and jelly powder. Have the children individually or in small groups taste the ingredients to identify them and then try to make each item disappear in a plastic cup of water. Have the children draw pictures of the things that dissolved in water around the picture of the magician on the student activity sheet. Have them label their illustrations.

You might prepare a glass of salt water without the students' knowledge. Have them tell whether they think the water is pure and give their reasons. Have them taste it and then state their conclusions. Point out to them that they could not tell that there was salt in the water until they had tasted it. Develop the idea that we cannot *always tell* that water is clean just by looking at it or even by tasting it. If the children are going to try to find out whether other substances will dissolve in water, thought must be given to choosing substances that they can safely taste.

Other magic tricks with water suggested in the following activities may also be recorded on the student activity sheet.

Follow-up Activities

1. To show your class the changes of state of water, use a paper cup of water and a paper cup of ice. Put the cup of water in the freezer and allow it to freeze. At the same time allow the cup of ice to melt. Have your students observe the changes. Point out that energy is involved in changing the state of water. Have the children note that the water expanded when it froze and which change of state was completed first (melting or freezing). Discuss with them the important uses we have for ice. Have them describe the characteristics of water as a liquid and as a solid.

2. To show that water can disappear (evaporate), set out in the classroom two glasses containing the same amount of water. Cover one glass tightly with cellophane and an elastic. Have the class observe the glasses daily for several days and consider the following questions: Where did the water go? What will happen to it? (Relate their observations to the water cycle.) Discuss other times when water disappears (e.g., from clothes on the line, dishes on the counter, a fish tank, from the body through perspiration, from the sidewalk after a storm, when water boils away).

3. Ask students to use an egg poacher to cook their breakfasts using steam. Have them name other ways we use steam (e.g., for ironing, for powering boats and trains, in industry, and for sterilizing).

4. On the back of their student activity sheets, the children can show how they made the salt appear in the bottom of the pan during the experiment with salt and water in activity set 4.

Related Ideas

1. Have students make pictures to show how we use water as a solid, liquid, and/or vapour. They should print a sentence for each picture.

2. Have students pretend they are magicians. Then have them make a booklet like the one illustrated here to show some tricks they can do with water (e.g., make it change state, make it disappear, dissolve substances).

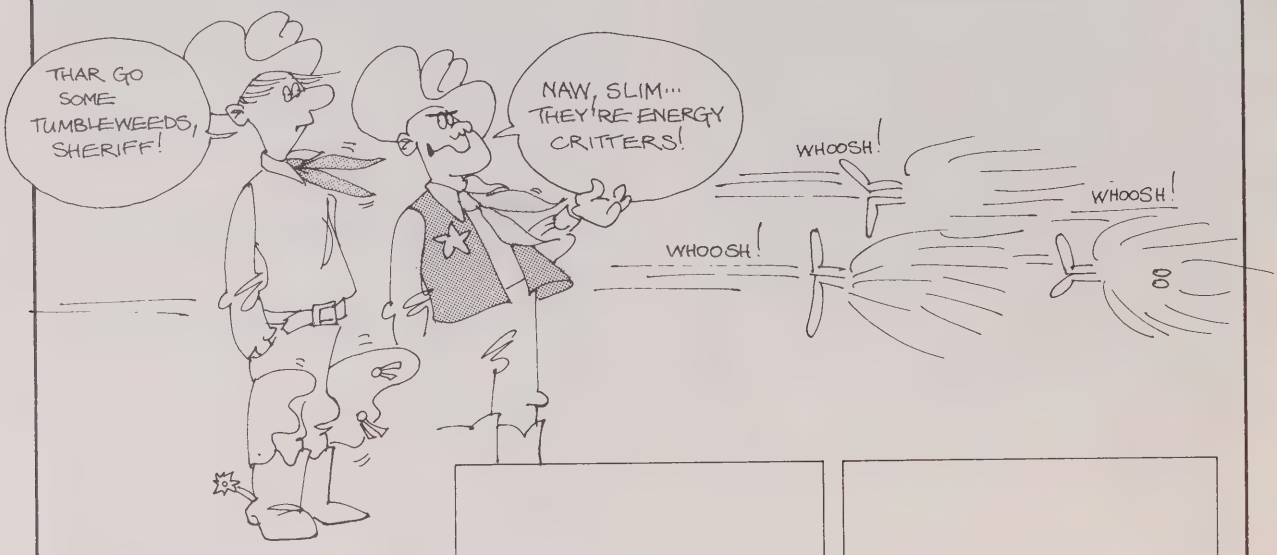
3. Have students freeze water in containers of different shapes and sizes. Have them time how long each takes to freeze and discuss any differences. *Do not use glass containers.*

4. Have the children compare the capacity of a variety of different-sized containers at the water centre or measuring centre. Pictures may be drawn to show the ordering of containers from largest to smallest, how many baby-food jars of water fill a jug, and so on.

5. Have students make popsicles. They can design popsicle people using different shapes and give their popsicles catchy names (e.g., Ollie Orange). Ask them to write the life story of their popsicles.

Name:

Air Is All Around You



Moving air is called _____.

I know air is moving when I see:

1

2

3

4

5

Notes

Air is all around us, even though we cannot taste, smell, or see it. The purpose of this activity set is to help the children develop an awareness that air is everywhere and to identify wind as moving air.

We can live without air for less than 10 min. Despite its importance, however, we do not see air because it is transparent. Air is a mixture of gases. The air around the earth is called the atmosphere. Wind is moving air, and is caused by the circulation of warm and cold air and the heating of the atmosphere by the sun.

Introduce the lesson with the following riddle:

Sometimes it is full of rain.
Sometimes it is full of snow.
Sometimes it is moving
And makes the sailboats go.
It's most important for people.
For plants and animals too.
It's right here in our school room
And all around you.
What is it?

From Matthew J. Brennan (ed.), *People and Their Environment, Teacher's Curriculum Guide to Conservation Education* (Chicago: J. G. Ferguson Publishing Company, 1969), p. 119. Reprinted by permission.

Have the children wave their hands back and forth to feel the air in the room. On a windy day, ask the children to describe the weather. What makes it windy (moving air)? How can they tell the air is moving when they are outside (e.g., the movement of trees and grass)? Have the children go outside and find other things that show that air is moving (e.g., a flag, paper, clouds, kites, waves, moving water in a puddle, seeds, hair). Have them complete the student activity sheet to show their observations.

Follow-up Activities

1. Have students make pictures or compose a list of things that, like the wind, exert a force (push or pull objects), e.g., elastic, magnets, muscles, gravity. They can use the back of their activity sheets for this purpose.

2. Show the children that air hides in soil. Take a glass half-filled with soil. Pour water into the glass. Observe the bubbles coming to the top. The air bubbles come from the soil.

3. Have the children suggest ways that moving air can help save energy (e.g., it dries clothes and hair, cools, turns windmills, moves sailboats) and discuss their ideas.

Related Ideas

1. Have the children blow bubbles into a glass of water through a straw *or* blow soap bubbles and listen to the puff of air come out when the bubbles burst. Lead the children to the realization that the air came from their bodies..

2. Play a game using three glasses. Ask a child to bring you the one that's empty. The trick is that all are filled with air. None are empty. Ask how you would get the air out (i.e., create a vacuum).

3. Print rhyme words for air on a parachute shape like the one illustrated here.

4. Have the children paint a picture showing a windy day.

5. Have students write a story that tells about the wind as a mischief-maker (e.g., it blows off hats, scatters newspapers, blows dirt on a freshly painted fence).

6. Ask the children how they might show that plants need air. An experiment might be done in which a plastic bag is placed over a plant and the air removed. Students should continue giving the plant water and sunlight and observe the changes over several days.

7. Have the children do research on hurricanes and tornadoes, and share their information. They should find out what the characteristics of a hurricane or tornado are and what causes each. This research could be presented in the form of a booklet, story, or student-made filmstrip.

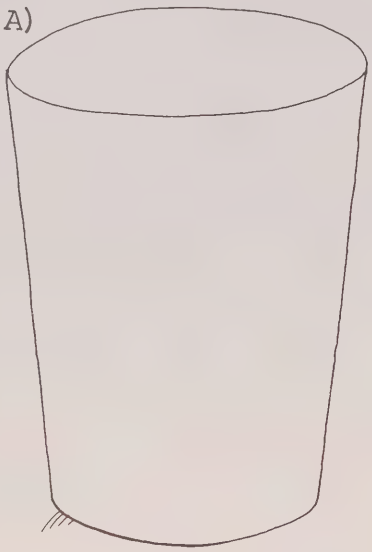
Name:

All Living Things Need Air

You need: a blotter
two glasses
soil
water
lima beans

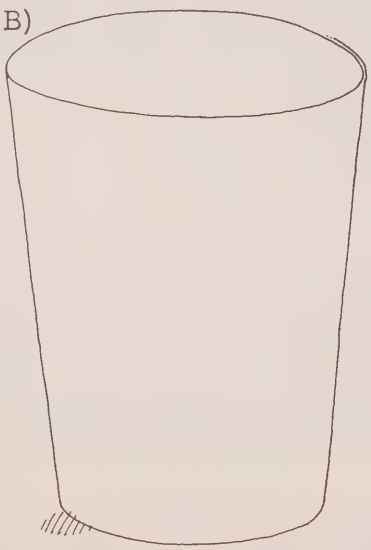
Complete the pictures.

A)



a little water

B)



a lot of water

This is what happened to each plant in:

1. 3 days

a)	b)

2. 5 days

a)	b)

3. 7 days

a)	b)

4. 10 days

a)	b)

Notes

The air we breathe is the most important need of all living things. This activity set is intended to show the children that things cannot live without air.

Air is a mixture of gases. When we breathe, air travels down our windpipe and into our lungs. Oxygen from the air goes into our blood. The blood carries the oxygen to all parts of our body. The oxygen unites with the tissues and produces heat which keeps our body temperature uniform. Oxygen is also needed for combustion or chemical reactions.

Most animals breathe through lungs. Plants take in air from tiny holes in their leaves, which are called *stomata*. Fish breathe through gills, and grasshoppers breathe through little holes in their abdomens.

Ask the children what is more important than eating or drinking. Discuss the importance of air and oxygen to human life. If the children play a table-top game of hockey using a Ping-pong ball for a puck and blowing through drinking straws to direct the "puck", they will soon realize the importance of air to human life.

To continue the demonstration of the importance of air to living things use the following experiment as a class activity and have the children complete the student activity sheet.

With the children prepare two glasses (or transparent plastic cups) by positioning in each several lima beans between a blotter and the sides of the glass. Fill each glass with dry soil, and label one A and the other B. Moisten the soil a little in glass A and saturate the soil in glass B.

The children should be directed to observe the air bubbles that show air escaping from the soil until the bubbles are no longer visible in glass (B). On the student activity sheet have the children illustrate the words "blotter", "glasses", "soil", "water", and "lima beans", and then finish the illustrations to show what they did. Have the children use the rest of the activity sheet to illustrate the changes they observe in the bean seeds at the various times stated.

Follow-up Activities

1. Watch the film *Take a Deep Breath* from OECA's All About You series. This film shows how fresh oxygen enters the body and how air is exhaled. An experiment in the film shows the quantity of air that the lungs can hold. This activity can be linked to the activities on air pollution in activity set 12.

2. Discuss with students how plants and animals use air. Plants breathe through stomata in their leaves. Provide the children with information on how fish and grasshoppers breathe.

3. Discuss some recreational activities that require a supply of air (e.g., scuba diving, mountain climbing).

Related Ideas

1. Show pictures of or discuss good places for children to play. Have pictures of an old refrigerator, a chest, a freezer, and a plastic bag. Discuss where we might find these articles and why they are dangerous. Relate this to our need for air.

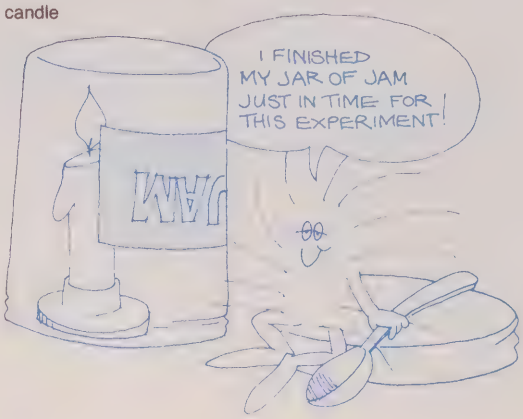
2. Make a co-operative list to show what all living things need. Discuss what would happen if one of these necessities were taken away.

3. Have the children make a list of needs they have as members of their community (e.g., food, shelter, clothing). Which could they live without?

4. Have the health nurse come in to give a presentation on how we breathe.

5. To show that oxygen is needed for combustion, burn a candle and cover it with a jar as in the accompanying illustration. As the oxygen is used up, the candle begins to flicker and go out. Relate this to what happens to us if we do not have air.

candle



Reference

Take a Deep Breath. All About You. OECA, BPN 108909. Colour, 15 min. Expiry date: August 31, 1981.

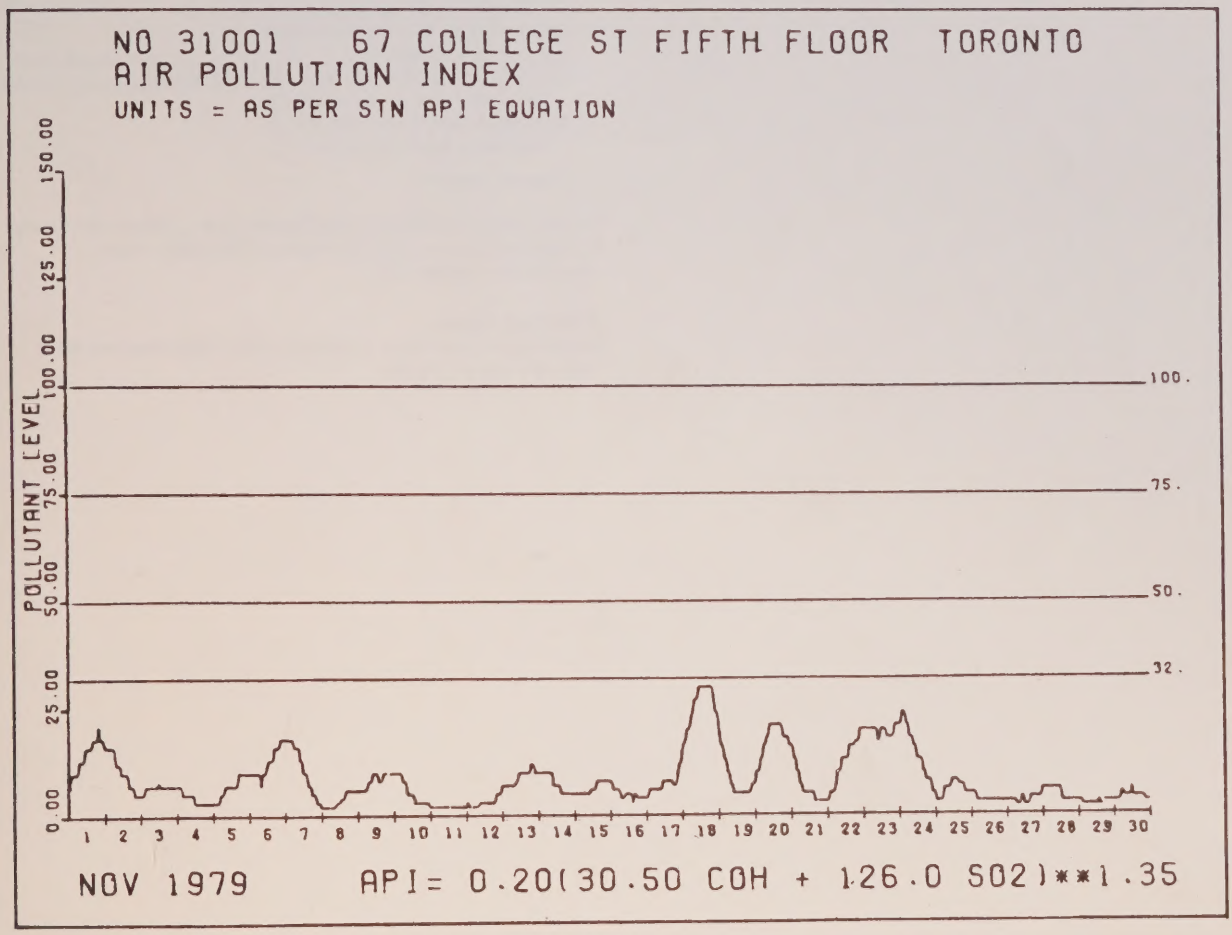
Name:

Air Pollution

Notes

Air sometimes carries particles that are invisible. This activity set encourages the children to become aware of these particles and to identify where the particles come from that pollute the air.

Air contains many particles that are invisible if not present in great quantities. 6.25 cm^3 of air usually contains about 100 000 solid particles. We can see puffs of smoke, which are large quantities of particles crowded together. Other particles found in the air include salt from the ocean, pollen from plants, and tiny living things called *microbes*. The particles in the air, then, are solids, living things, liquids, and gases. The accompanying graph gives air pollution levels in Toronto for the month of November 1978. Note that the level above which air pollution is not acceptable is 32. When was that level exceeded? What gases are also monitored?



To demonstrate that there are particles in the air, show the children two microscopic slides and a jar of petroleum jelly. Ask them how we can use these materials to show that there are particles in the air. (Rub the petroleum jelly on the slides and leave them outside.) Ask the children what they think will happen. Place the slides in an open area away from sand. In two or three days, have the children examine them under a magnifying glass. What do they notice? Where might the particles have come from?

Follow-up Activities

1. Have a child blow out a candle. The candle smokes. What is going into the air? Have the children hold a spoon over the burning candle and observe the carbon deposits that form on it. Ask the children what other things would pollute the air (e.g., factories, mills, aerosols, smoking, burning garbage, vehicle exhausts), and what we can do to help remedy air pollution (e.g., keep a compost pile rather than burning trash, refrain from smoking, write letters to industries complaining of their pollution, walk or ride a bike instead of using a car).

2. Have the children ask their parents to show them their furnace filter. Then have them share their findings with the class. How many times a year must it be replaced (every two months)?

3. Read the children the poem "Trails of Smoke" by Rowena Bennett and discuss it using the following questions: What kinds of things cause air pollution in the poem? Why are the roads "plodding" roads? How might the birds flying in the sky feel?

Trails of Smoke

When I'm an aviator
  And have learned to use my wings,
I'll soar above the barn roof
  Where the swallow sings,
Above the fork of lacy elm,
  Above the towering oak,
And near a leafy rim of sky
  I'll follow trails of smoke.

Such travels as puffing engines make
  Where they climb a purple hill;
Such trails as reaching chimneys spin
  From factory and mill.
Oh, the roads of the world are plodding roads!
  And they're for earth-bound folk;
But I shall climb with metal wings
  And follow trails of smoke.

Rowena Bennett

From Leland Jacobs and Sally Nohelty (eds.), *Poetry for Young Scientists* (Toronto: Holt, Rinehart and Winston, 1964). Reprinted by permission.

Related Idea

Have the children make a poster to show what they can do to help remedy air pollution.

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